TITLE:
PALESTINIAN GUIDELINES FOR DIAGNOSIS AND MANAGEMENT OF BRONCHIAL ASTHMA

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Guideline is adapted from valid international guidelines.

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DISEASE/CONDITION:
Bronchial asthma

CATEGORY:
Diagnosis and treatment and referral.

CLINICAL SPECIALTY:
Family Practice. paediatrics, pulmonary medicine, Internal Medicine, Primary care.

INTENDED USERS:
General Practitioners, Physicians and pulmonary specialists at secondary care, Nurse Practitioners.

TARGET POPULATION:
All individuals living in Palestine with bronchial asthma.

GUIDELINE STATUS:
This is the current release of the Bronchial Asthma Guidelines.

GUIDELINE AVAILABILITY:
Hard and electronic copies.
www.moh3.com
www.healthinforum.com

REVIEW METHODS:
Peer Review.

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OBJECTIVES:
1. To promote evidence-based Diagnosis and management guideline of bronchial asthma suitable for local situation which will help improving patient's clinical outcomes.

2. To help primary and secondary heath care providers in the early diagnosis of bronchial asthma, proper clinical assessment and delivery of appropriate individualized interventions.
3. To promote patient and or parents (or family) in sharing of bronchial asthma management.
4. To help in reducing the outcome of chronic complications of bronchial asthma.

GUIDELINE DEVELOPMENT METHODOLOGY:

The model for developing this guideline is based on Paul Batalden's framework for the continual improvement of Health care. This framework suggests the integration of subject matter knowledge with improvement knowledge as a powerful means of continual improvement in health care. This framework was previously and successfully implemented by Dr. Rashad Masoud of the QAP/URC-CHS who translated the framework to a methodology for clinical guideline development. This methodology will be followed in the development of this guideline. The main steps in this methodology are:

1. Description of the existing system of bronchial asthma care delivery.
2. At each step in the process of health care delivery, make explicit what, if any, clinical content is involved.
3. Review evidence based international guidelines on the subject matter of the clinical guideline.
4. Update the clinical content in accordance with the Evidence-Based Medicine knowledge of the subject matter encountered in the international guidelines
5. Introduce changes to the system of care to enable the implementation of the updated content knowledge.
6. Review the indicators to ensure that they reflect the changes in both subject matter knowledge and changes in the system of care.

INTERVENTIONS AND PRACTICES:

DIAGNOSIS:

1. Diagnosis of bronchial asthma.
2. Classification of chronic asthma severity.
3. Patient history pertinent to bronchial asthma.
4. Physical examination for asthmatics.
5. Confirmatory tests.
6. Assessment of triggering factors related.
7. Assessment of adequacy of bronchial asthma control.
8. Diagnosis of acute severe or life-threatening asthma.

MANAGEMENT/TREATMENT:

1. Health education.
2. Pharmacologic therapy including the management plan.

3. Management of acute severe asthma in adults and school children.
4. Management of acute severe asthma in children less than 5 years.

OUTCOMES CONSIDERED:

1. PEF measurements.
2. Tolerability of therapy.
3. Morbidity and mortality due to Bronchial Asthma.

QUALIFYING STATEMENTS:

Although this guideline represents the best evidence-based practice on the date of its publication, it is certain that medical practice is evolving and that this evolution will require continuous updating of published information. In addition, the reader is reminded that this document is intended as a guideline and should not supersede the clinical judgment of the health care provider.

Preface

Globally, chronic conditions are accelerating regardless of the region or the social class. Developing countries are going into demographic and epidemiology transition from communicable to non communicable diseases By the year 2020 chronic conditions including injuries and mental disorders will be responsible for 78% of the global disease burden in developing countries. Palestine is one of the developing countries where the burden of such diseases is expected to exhaust its medical and financial system so an urgent action should be taken.

Part of this action is the development of clinical practice guidelines to assist practitioner and patient decision about appropriate care for specific clinical circumstances. These guidelines will also play a vital role in standardizing the health care provided to the chronic patients.

The Palestinian Ministry of Health was therefore committed to improve the quality of health care provided to the chronic patients. This commitment resulted in the establishment of the National Chronic Disease Committee in 2000. The aim of the National Chronic Disease Committee was to develop a comprehensive and integrated chronic diseases care system part of which is the development of chronic diseases clinical practice guidelines for ten selected chronic diseases.

The Ministry of Health is proud to produce the first edition of “Palestinian Guidelines for Diagnosis and Management of Bronchial Asthma " which will play a vital role in standardizing and improving the quality of care provided to the Asthmatic patients. This guideline was produced despite the obstacles and the continuous political challenges facing the Palestinian

population in general and the Ministry of Health staff in particular.

This guideline has benefited from the support and contribution of many individuals. The Ministry of Health is grateful and indebted to His Excellency, Dr. Riyad Al Zanoun (Ex-Minister of Health) for his great efforts support in the first stage of this work. Special thanks are also forwarded to His Excellency, Dr. Munzer Al Sharif, the Deputy Minister for the continuous support and commitment.

The Ministry of Health also owes a great debt of gratitude to the team who participated in the development and revision of the guideline and to the Quality Improvement Project for their dedicated efforts to ensure compliance of this guideline to the international standards.

Dr. Jawad Tibi
Minister of Health
Palestine

FOREWORD FROM THE TEAM LEADER:

Asthma is a common chronic disease, the treatment of which must largely occurs in general practice. The condition has recently shown an alarming increase in prevalence worldwide, and this is not just due to increased awareness of its existence amongst practitioners. Despite the absence of reliable statistical data about bronchial asthma in Palestine, many practitioners in the field are really worried about the increasing morbidity and mortality from this disease worldwide.

In recent years there has been a huge increase in our level of knowledge about this condition, and as a result, several guidelines have been produced which have been based on sound scientific evidence. These guidelines have been broadly accepted across the medical spectrum. The difficulty that many medical practitioners now have is not the lack of knowledge or understanding, but rather the transfer of this into their everyday management to reduce the gap between their acceptance to these guidelines and their implementation. This publication sets out to tackle that very problem.

These are not just another set of guidelines. The Palestinian MOH task force of this condition has taken the most important and up to date information from material already available and accepted worldwide, and has written this detailed guidelines text, designed the essentials guidelines and arranged them in an easy to use charts, tables and flow sheets which can be readily accessed on the practitioners desk, in the patients notes and most importantly by the use of self-management plans in the patients pocket or wallet.

Much credit is due to the bronchial asthma task force for the huge amount of hard work and energy they have put into this project and great thanks to the QIP staff for the effective contributions they made to the production of this guideline. This publication should greatly help to improve the quality of asthma care offered by us to our asthma patients and ensure optimal therapy for everybody with this treatable condition

Dr. Abdul Mutaleb T. El-Qawasmeh
Leader of the task force, bronchial asthma
Director General, Family Practice/MOH.
November 2003

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LIST OF ABBREVIATIONS:

Essential Drug List	EDL
Excecise induced Bronchospasm	EIB
Forced Expirotary Volum in first	$P.E.V_1$
General Anaesthesia	GA
General Practitioners	G.P
Intensive Care Unit	ICU
Leukotriene receptor antagonists	LTRA's
Long acting B agonist	LABA
Meter Dose Inhaler	MDI
Ministry of Health	MoH
None Steroidal anti Inflammatory Drug	NSAID
Peak Expirtory Flow Mete	PEFM
Peak Flow Rate	PFR
Peak expirtory Flow	PEF
Self Manaement Plan	SMP

INTRODUCTION:

Bronchial asthma is a common disease, it affects 5-10% of the population worldwide and its incidence is increasing world wide. More recent increases in asthma mortality are reported from Britain, France and the USA. May be related to the increased prevalence or severity of asthma or inadequate health care.

Palestine is no exception, particularly during the current Intifada, where our people are exposed to different kinds of war gases. Unfortunately we in the MOH badly need to plan and launch different kinds of studies to establish effective data-base about this important disease inorder to identify the current size of the problem and the necessary kind of interventions.

Asthma mortality and morbidity are still unacceptably high ? this has been in part attributed to an overreliance on bronchodilators, with the underuse of inhaled oral anti-inflammatory treatment and failure to make objective measurement of severity.

There has also been an increasing awareness that asthma tends to be underdiagnosed and undertreated, and it is only in recent years that the underlying inflammatory nature of the disease has been well recognized.

The plethora of medicinal agents of various categories and their possible use in different modes has made difficult for the medical practitioner treating bronchial asthma to keep up to date.

In Palestine, the belief by certain sections of our community that asthma medicine, especially if given long-term, will weaken the child, cause addiction and affect growth and intellectual development, compounds the problem of proper management of childhood asthma. Fear of side effects hinders the use of inhaled steroids in adults.

There are also substantial economic costs. These include costs related to health services, loss of school and work time leading to poor scholastic performance and decreased productivity, disease-related morbidity and premature mortality. Asthma care is most expensive when the patient is treated in hospitals and emergency departments.

Keeping in mind the positive impact in western countries of the management guidelines for the treatment of asthma, a selected group of experts from paediatric/adults pulmonology Primary Health Care, Nurses involved in managing asthma were invited by the Palestinian MOH to participate in this task force.

A stepwise approach, both stepping up and down, for the management of asthma is followed with charts summarizing the recommendations suitable for use in the outpatient clinics, inpatient wards and emergency departments. This protocol is meant to be revised periodically to keep up with this rapidly advancing field.

PART ONE: DIAGNOSIS OF BRONCHIAL ASTHMA:

1. Definition of Asthma:

Is a chronic inflammatory disorder of the airways in which many cells play a role, in particular mast cells, eosinphils and T lymphocytes.

In susceptible individuals this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness and cough, particularly at night and/ or in the early morning.

These symptoms are usually associated with widespread but variable airflow limitation that at least partly reversible, either spontaneously or with treatment. The inflammation also causes associated increase in airway responsiveness to a variety of stimuli.

2. Diagnosis: *(Refer to page 5)*

There is no gold standard for the diagnosis of asthma
The diagnosis requires a detailed medical history & clinical examination, including measures of Peak Flow Rate; (PFR).

2.1 History taking:

2.1.1 Symptoms: Cough, wheezing and shortness of breath are the most important symptoms and should be inquired about in detail, stressing the following points:

- Frequency, severity and duration.
- Aggravation by activity or worse at night, especially between attacks.
- How symptoms are interfering with sports and normal physical activity and any resultant loss of time from school or work.
- Response to previous treatment.

2.1.2 Possible associated features are:

- Family history
- Personal atopy history; skin eczema, allergic conjunctivitis, Hay fever, allergic rhinitis or sinusitis.
- The presence of precipitating factors for wheeze, such as viral infection, allergens, stress, drugs, smoke, other pollutants, & other factors.

2.2 Examination:

2.2.1 General:

- Height. (first visit) or if otherwise indicated.
- Weight (in children as appropriate.
- Mental Status,
- colour.
- Pulse, Respiratory rate, Peak Expiratory Flow (PEF), and temperature if appropriate.
- Nose, throat & para-nasal sinuses (if indicated from the history).
- Features of atopy in children and adults (if indicated from the history).

2.2.2 Specific:

- Chest: can be normal, deformity (chronic uncontrolled asthma), excessive use of accessory. muscles; intercostal / sternal recession (more marked in children).
- Auscultatory findings; expiratory and or inspiratory rhonchi or silent chest.

The diagnosis should be made positively by using a Peak Expiratory Flow Meter; PEFM, to show either:

A. Daily variability of > 20%, or

B. >15% reversibility after inhaled β_2 agonists or

C. If necessary:
   - Trial of oral steroids for up to 2 weeks should show>20% improvement.
   - Or fall of **≥** 20% in PEF after exercise (Appendix 3).

Diagnosis can be based on either or both clinical or PEF criteria:

In young children PEF measurements are not possible and the diagnosis is based on the response to treatment.

The diagnosis of asthma will be missed if doctors fail to realize that cough can be the initial and sometimes the only manifestation of asthma (Annex 7).

2.3 Differential Diagnosis:

2.3.1 Some medical conditions in the new adult patient must be excluded such as:

- Anxiety or psychogenic hyperventilation syndrome.
- Heart disease.
- Acute bronchitis.
- Bronchiectasis.
- Pulmonary emboli.
- Chronic obstructive airway disease.
- Gastro-eosophageal reflux.
- Pulmonary fibrosis.
- Foreign body.
- Vocal cord dysfunction.
- Tumour: laryngeal, tracheal, and lung.

2.3.2 Alternative diagnosis in wheezy children:

Table (1): Alternative diagnosis in wheezy chest:

Clinical clue	Possible diagnosis
Perinatal and family history	
• symptoms present from birth or perinatal lung problem	• Cystic fibrosis, chronic lung disease; ciliary dyskinesia; developmental anomaly
• family history of unusual chest disease	• neuromuscular disorder.
• severe upper respiratory tract disease	• Defect of host defence
Symptoms & signs	
• persistent wet cough	• cystic fibrosis; recurrent aspiration; host defence disorder
• excessive vomiting or possiting	• reflux (± aspiration)
• dysphagia	• swallowing problems (± aspiration)
• abnormal voice or cry	• laryngeal problem
• focal signs in the chest	• developmental disease; postviral syndrome; bronchiectasis; tuberculosis
• inspiratory stridor as well as wheeze	• central airway or laryngeal disorder
• failure to thrive.	• cystic fibrosis; host defence defect; gastroesophageal reflux
• wheezy chest in small children with or without tachypnea preceded by symptoms of URTI.	• bronchiolitis in small children.
Investigation	
• focal or persistent radiological changes	• developmental disorder; postinfective disorder; recurrent aspiration; inhaled foreign body; bronchiectasis; tuberculosis.

2.4 Investigations:

2.4.1 Are usually not necessary.

2.4.2 Chest x-ray should be done for all new patients.

2.4.3 During the acute attack, chest-x-ry is usually not necessary unless otherwise indicated as in:

- Suspected pneumomediastinum or pneumothorax.
- Suspected consolidation.

- Life-threatening asthma.
- Failure to respond to treatment satisfactorily.
- Requirement for ventilation.

2.4.4 Arterial blood gases are indicated in severe cases (hospital).

2.4.5 Other investigations may be necessary to prove the diagnosis when history & physical examination are indeterminate or if other diagnoses are suggested by the clinical findings.

3. Diagnosis of Acute Severe and Life threatening asthma:

Table (2): Diagnosis of acute sever and life threatening asthma:

ADULTS	
ACUTE SEVERE • Pulse > 110 • Respiration ≥ 25 breaths / min, • Can't complete one sentences in one breath • PEF ≤ 50% predicted or best	**LIFE THREATENING** • Cyanosis, • Exhaustion, • Confusion, or coma, • Bradycardia, • Hypotension • Silent chest, or • Feeble respiratory effort, • PEF < 33% predicted or best.
CHILDREN	
ACUTE SEVERE • Pulse ≥ 120 (different ages have different rates see table 3) • Respiration ≥ 40 breaths / min (different ages have different rates see table 3), • Too breathless to talk or feed, • PEF ≤ 50% predicted or best	**LIFE THREATENING** • Cyanosis, • Fatigue or exhaustion, • Agitation or reduced level of consciousness • Silent chest, or poor respiratory effort, • PEF < 33% predicted or best. • Hypotension • Fall in heart rate.

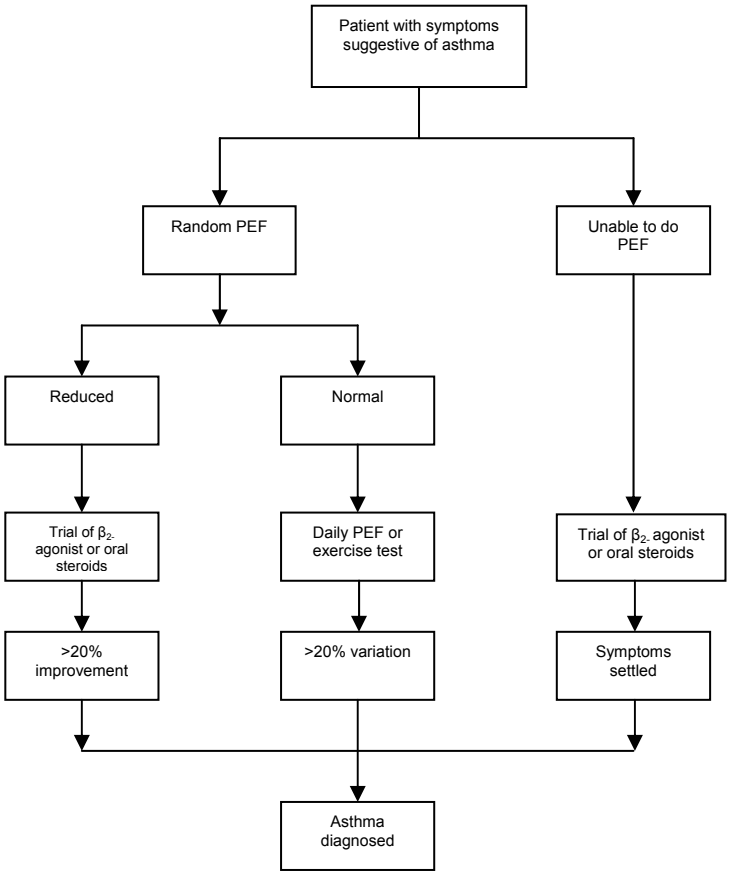
If PEF is not available, this should not delay urgent treatment

Pulse oximetry, may give additional information if available.

Table (3): Normal respiratory and pulse rates in children:

Pulse Rate in Children		Respiratory Rates in Children:	
Age	**Pulse rate**	**Age**	**Respiratyory rate**
2-12 months	< 160/min	<2 months	<60/min
1-2 years	<120/ min	2-12 months	<50/min
2-8 years	<110/min	1-5 years	<40/min
		6-8 years	<30/min

Diagnosis of Bronchial Asthma:



PART TWO: CLASSIFICATION OF THE SEVERITY OF ASTHMA:

Assessment of the Severity of Asthma: Is important because this will greatly influence therapy. If it is difficult to assess the patient severity, assign him to the more severe group in which any features occur. The degree of severity may change with time.

1. Stepwise approach for diagnosis of asthma in children ≤ 5 years (grades of asthma severity)

Table (4): Detailed stepwise approach for diagnosis of Chronic Asthma in Children ≤ 5 years:

Step 1 – Mild intermittent • Symptoms occurring ≤ 2 days / week, ≤2 nights / month • Asymptomatic between episodes • Exacerbation lasts ≤ few days.
Step 2 – Mild persistent • Symptoms occurring ≥ 2 days / week, ≥ 2 nights / month Asymptomatic between episodes • Exacerbation may affect activity
Step 3 – Moderate persistent • Symptoms are daily,≥ 1 nights / week • Asymptomatic between episodes • Exacerbation affects activity
Step 4 – Severe persistent • Symptoms are continuous,Nocturnal symptoms are frequent, • Limited physical activity • Exacerbation are frequent

Table (5): Summary Stepwise approach for diagnosis of Asthma in Children ≤ 5 years

Classification	Mild Intermittent	Mild persistent	Moderate persistent	Severe persistent
	Step 1	Step 2	Step 3	Step 4
Symptoms	≤2 days /week	≥2 days /week	Daily	Continuous
Exacerbations/ Nocturnal Symptoms	≤ 2 nights/Month	≥2 nights /month	≥1 night /week	Frequent

2. Stepwise approach for diagnosis of asthma in school children and adults (grades of asthma severity)

Table (6): Detailed stepwise approach for diagnosis of Chronic Broncial Asthma in school children and Adults:

Step 1 – Mild intermittent: • Symptoms occurring ≤ twice a week, ≤ 2 nights / month • PEF ≥ 80% of predicted or of personal best • PEF variability≤20%. • Asymptomatic with normal PEF between episodes, • Exacerbation's are brief (≤ 5 times per year).
Step 2 – Mild persistent: • Symptoms occurring≥twice a week≥ 2 nights / month • PEF≥80% of predicted or of personal best • PEF variability 20 to 30%. • Exacerbation do not require hospitalization
Step 3 – Moderate persistent: • Symptoms occurring daily, ≥ 1 night / week • PEF **≥** 60% - ≤ 80% predicted between attacks, • PEF variability **≥** 30% • Exacerbation's require hospital care,
Step 4 – Severe persistent: • Symptoms are continuous,Nocturnal symptoms & sleep disturbance ≥ five times a month, • PEF ≤ 60% predicted between attacks, • PEF variability **≥** 30% • Frequent exacerbation ER visits, ≥ 2 hospital visits per year,

Table (7): Summary stepwise approach for diagnosis of Bronchial Asthma in school children and Adults:

Classification	Mild Intermittent	Mild persistent	Moderate persistent	Severe persistent
	Step 1	Step 2	Step 3	Step 4
Symptoms	≤ 2 days /week	≥ 2 days /week	Daily	Continuous
Nocturnal symptoms	≤2 nights /Month	≥2 nights /month	≥ 1 night /week	Frequent
PEF between attacks	≥ 80%	≥ 80%	60-80%	≤ 60%
PEF variability	≤ 20%	20-30%	≥ 30%	≥ 30%

Step Classification of the Asthma Severity

	Day-time Symptoms	Night-time symptoms	PEF
Step 4 Severe Persistent	Continuous limited Physical activity	Frequent	≤60% predicated Variability ≥30%
Step 3 Moderate Persistent	Daily symptoms Use β2 agonist daily Attack affect daily activities	>1 time per week	>60% -<80% predicated variability ≥30%
Step 2 Mild Persistent	≥ twice per week <1 time a day	>2 times a month	≥80% predicated variability 20-30%
Step 1 Mild intermittent	≤ twice per week Asymptomatic and normal PEF between attacks	≤2 times a month	≥80% predicated variability ≤ 20%

Adaptec from GINA (Global strategy for Asthma Management and prevention guideline for children below 5 years PEF does not apply.
Symptoms wheeze, dyspncea and/or cough
The highest level of current severity defines the STEP category for each patient

PART THREE: MANAGEMENT OF CHRONIC BRONCHIAL ASTHMA:

1. Aims of management:

1.1 To abolish diurnal & nocturnal symptoms.

1.2 To restore normal or best possible long-term airway function (normal PEF>80%, PEF variability <15%).

1.3 To restore best activities.

1.4 To reduce the risk of severe attacks (exacerbations).

1.5 To enable normal growth to occur in children.

1.6 To minimize absence from school or work.

1.7 To achieve the best control with the least possible side effects from medications.

2. Components of the management of chronic asthma:

2.1 Health education including avoidance of trigger factors.

2.2 Pharmacotherapy included in the management plans.

2.3 Produce an action plan.

2.4 Follow-up and referral.

2.1 Health Education including avoidance of trigger factors:

Patient education: (written & oral) should be delivered at every step of medical care (GP & hospital). The education should talk about:

The basic facts about asthma; its natural history, identification various severity steps, and its treatment which should include:

2.1.1 Inhalation technique of various inhalation devices as appropriate to the patient, the use of the spacer, the use of the PEFM and how to record its measurements.

2.1.2 Instruction to ensure recognition of signs that asthma is worsening & especially awareness of the importance of nocturnal symptoms & changes in PEF.

Worsening of the patient condition is recognized by:

- Increasing symptoms, especially waking at night with asthma.
- Increasing physical intolerance.
- Increased need for more bronchodilators.
- Inability to achieve optimum PEFR after B2 stimulant.
- Failure of bronchodilators to relieve symptoms.
- Falling PEF.
- Increased PEF variability.

2.1.3 Rehearsal on Self Management Plan (SMP).

2.1.4 Information about prevention of exacerbation's and deterioration of lung function.

2.1.5 Sociocultural Misconceptions such as asthma is an infectious disease, asthma medications are addictive, participation of asthmatic patients in sports and other activities, and steroids as horrible medications and their role in pregnancy.

2.1.6 Medications: Explain the advantages of inhaled medications over systemic ones, differences between bronchodilators ("**relievers")** and anti-inflammatory treatment **("preventers**"), the reasons why the patient may need more than one inhaler type?, the role & difference of each and the potential adverse effects.

Practical tips for improving compliance:

A. Ask open-ended questions like "if we could make one thing better for your asthma what it would it be? This may help to elicit a more patient centered agenda.

B. Make it clear you are listening and responding to the patient concerns and goals.

C. Reinforce practical information and negotiated treatment plans with written instruction

D. Recall patients who miss appointments.

Avoidance of trigger factors:

A. Beta blockers (tablets & eye drops)
B. If Aspirin and NSAID's are known to induce asthma in the individual.
C. Allergens where relevant (Indoor & outdoor).
D. Occupational causes of asthma (Annex7).
E. Smoking; active and passive.

2.2 Pharmacotherapy and management plans:

There are separate management plans, one for children and another for adults and school children

2.2.1 Management of chronic asthma in children≤5 years:

- Patient should start treatment at the step most appropriate to the initial severity. Progression to the next higher step is indicated when control cannot be achieved at the current step and there is assurance that medication is being used correctly.
- **A rescue course of prednisolone** may be needed at any step with a dose of 1-2mg/kg body weight (maximum daily dose 40mg) should be used for one to five days; no tapering of this dose is needed.
- Avoidance of trigger factors where possible
- Working towards a self management plan
- Selection of best inhaler device
- Parent's and patients involvement & education as appropriate.

"Until growth is complete any child requiring Beclomethasone or Budesonide > 800μg daily or Fluticasone > 500μg g daily should be referred to a pediatrician with special interest in asthma."

Criteria for trying a trial of asthma therapy in children ≤ 5 years with atypical symptoms:

A. Both parents have asthma.
B. One parent has asthma.
C. Parental smoking at home.
D. Maternal smoking during pregnancy.
E. Family history of atopy.
F. Personal history of atopy.
G. Nocturnal respiratory symptoms.
H. Early morning respiratory symptoms.
I. Normal examination.
J. Normal height and weight percentiles.
K. Late onset of symptoms.

Table (8): Stepwise approach for Diagnosis and Management of chronic Bronchial Asthma in Children≤ 5 years:

Diagnosis	Management
Step 1 – Mild intermittent Symptoms occurring ≤ 2 days / week, ≤ 2 nights / month Asymptomatic between episodes Exacerbation lasts ≤ few days.	No daily preventive medication is needed. Occasional use of short acting β_2 agonists; no more than once daily. Use inhaled drugs wherever possible. (Bronchodilator syrups are much less effective than inhaled β_2 agonists & have more systemic side effects).
Step 2 – Mild persistent Symptoms occurring ≥ 2 days / week ≥ 2 nights / month Asymptomatic between episodes Exacerbation may affect activity	Intermittent inhaled short acting β_2 agonist **Plus** Regular inhaled anti-inflammatory agents: (by MDI via a spacer with or without face mask): Inhaled corticosteroid; Beclomethasone or budesonide 100-200μg twice daily **Or** leukotriene receptor antagonist (unless contraindicated for age), if inhaled steroid cannot be used
Step 3 –Moderate persistent Symptoms are daily, ≥ 1 nights / week Asymptomatic between episodes Exacerbation affects activity	Inhaled short acting β_2 agonist as required **Plus** Inhaled corticosteroids Beclomethasone or budesonide increased to 200-400μg twice daily, via a spacer • Consider a trial of leukotriene receptor antagonist
Step 4 –Severe persistent Symptoms are continuous, Nocturnal symptoms are frequent, Limited physical activity Exacerbation are frequent	Inhaled short acting β_2 agonist as required **Increase** Beclomethasone or budesonide up to 400μg twice daily, via a spacer (if not already on the dose). **Plus** • Addition of regular steroid tablets ; or • consider referral to hospital paediatrician particularly for the children below the age of 2.
Step down: Regularly review the need for treatment every 1-6 months -Stop regular anti-inflammatory treatment after 6-12 months of few or no symptoms	If symptoms are seasonal consider stopping ant-inflammatory drugs at the end of the season.

2.2.2 Management of chronic asthma in school children and adults:

- Patient should start treatment at the step most appropriate to the initial severity and the Progression to the next higher step is indicated when control cannot be achieved at the current step and there is assurance that medication is being used correctly.
- A rescue course of prednisolone may be needed at any step to control asthma exacerbation's at any step by giving 30-60mg of prednisolone immediately. Continue this dose each morning until two days after control is established. Indications may include the following:
  - Symptoms get progressively worse day by day.
  - PEF falls below 60% of predicted value.
  - Morning symptoms persist until midday.
  - There is diminishing response to inhaled bronchiodilators.
  - Emergency use is made of nebulised or injected bronchiodilators.
- Avoidance of trigger factors where possible
- Patient's involvement & education
- Working towards a self management plan
- Selection of best inhaler device

Table (9): Stepwise approach for the diagnosis and management of Chronic Bronchial Asthma in school children and Adults:

Diagnosis	Management
Step 1 – Mild intermittent: Symptoms occurring ≤ twice a week, ≤ 2 nights / month PEF ≥ 80% of predicted or of personal best PEF variability ≤ 20%. Asymptomatic with normal PEF between episodes, Exacerbation's are brief (≤ 5 times per year).	• Occasional use of short acting β_2 agonists; no more once daily. • No daily preventive medication is needed. • If there is a clearly defined seasonal trigger, give low-dose inhaled steroid or nedocromil.
Step 2 –Mild persistent: Symptoms occurring ≥ twice a week, ≥2 nights / month PEF ≥ 80% of predicted or of personal best & PEF variability 20 to 30%. Exacerbation do not require hospitalization	• Inhaled short-acting β_2 agonists as required **Plus** • Regular low dose inhaled anti-inflammatory agents: Beclomethasone or budesonide 100-400μg twice daily or fluticasone 50-200μg twice daily, (400μg/d of beclomethasone is an appropriate dose for many patients)
Step 3 –Moderate persistent: Symptoms occurring daily, ≥ 1 night / week PEF **≥** 60% - **≤** 80% predicted between attacks PEF variability **≥** 30% Exacerbation's require hospital care	**Add- On Therapy** 1.Add inhaled long acting β_2 agonists (LABA) 2.Asses control of asthma; -good response to LABA- continue LABA -benefit from LABA but control still inadequate continue LABA and increase steroid dose to 400μg twice daily (if not laready on this dose) -no response to LABA, stop LABA and increase inhaled steroid to 400μg twice daily.if control still inadequate, institute trial of other therapies, e.g. leukotriene receptor antagonist or SR theophylline.
Step 4 – Severe persistent: Symptoms are continuous,Nocturnal symptoms & sleep disturbance ≥ five times a month PEF **≤** 60% predicted between attacks PEF variability **≥** 30% Frequent exacerbation ER visits, ≥ 2 hospital visits per year,	• Inhaled short-acting β_2 agonists as required **Consider trial of:** -increasing inhaled steroid up to 1000μg twice daily -addition of a fourth drug e.g. leukotriene receptor antaginist, SR theophylline. **If no response consider:** **-continuous or frequent use oral steroids*** in lowest dose providing the patient maintained on high inhaled steroid 1000μg twice daily or -refer patient for specialist care.
Step down: • Review treatment every 1-6 months, a gradual stepwise reduction in treatment may be possible if control is achieved. • In patients whose treatment was recently started at step 3 or 4 or included steroid tablets, this reduction may take place after a short interval	• In patients with chronic asthma a 3-6 month period of stability should be shown before slow stepwise reduction is undertaken • If symptoms are seasonal consider stopping ant-inflammatory drugs at the end of the season.

*** Patient on** long term systemic corticosteroids can develop the following side effects: hypertension, DM, Osteoporosis, growth retardation, catarct and glaucoma

2.2.3 Vaccination:

Patients with moderate to severe asthma might be advised to receive an Influenza vaccination every year.

2.2.4 Grades of Asthma Control:

Asthma Control:

As with asthma severity, asthma control can be graded in accordance with its clinical pattern, treatment requirements and severity of airflow obstruction. Using these criteria it is possible to define three levels of asthma control:

Good control

Poor control

Very poor or no control

- **Good asthma control:**

  Patients with good asthma control experience cough, wheeze, or dyspnoea less than once a week. Nocturnal symptoms occur less than twice a month. PEF ≥ 80% of best & PEF variability ≤ 20%. Inhaled short acting β_2 agonists are being used less than once a week.

- **Poor asthma control:**

  Patients with poor asthma control have symptoms which occur once or more a week but less than once a day over at least three months. Some exacerbation's may affect activity and sleep. Nocturnal asthma symptoms occur more than twice a month. Symptomatic treatment with a short acting β_2 agonists is required almost once a day.

  Pretreatement baseline PEF is > 60% - < 80% best and variability is > 20% -< 30%.

- **Very poor or no control:**

  Patients with very poor control of their asthma experience daily symptoms. Asthma symptoms affect activity most of the time. Night time symptoms occur more than five times a month. Short acting β_2 agonists are being used daily. PEF is < 60% of best & variability is > 30%. Such patients are at risk of an acute severe asthma attack which could be life threatening.

Table (10): Grades of Asthma control:

Control Grade **Criteria**	**Good**	**Poor**	**Very poor/ no control**
Daytime symptoms Cough/wheeze/dyspnoea	< once a week	≥ once a week	Continuous
Night time symptoms Cough/wheeze	< twice a month	> twice a month	> once a week
Limitation of activity due to exacerbations	Never	Occasional	Most of the time
Inhaled β_2 agonists for symptom relief	< once a week	> once a week but < once a day	Every day
Highest peak flow reading over two weeks	≥ 80% of best	> 60%-< 80%	< 60% of best
Peak flow variability	≤ 20%	> 20% -< 30%	> 30%
Treatment step	No change ? step down	If compliance and good inhaler technique confirmed. Move up one step. ? course of oral steroids.	If compliance and good inhaler technique confirmed. Move up one or two steps. Plus course of oral steroids

2.3 Self Management Plan "SMP" :

It is an agreement between the patient and his doctor and or the specialised nurse about the steps the patient can take to deal with episodes of asthma before calling for medical help.

2.3.1 Aim:

Enable people with asthma to take care of their asthma themselves.

2.3.2 Objectives of the “SMP”:

- To Increase the participation of the patient and or his family in the management of asthma through increasing his ability to:
  - Monitor asthma control by the PEF meter.
  - Recognize symptoms of deteriorating asthma (2.1.2)
  - Adjust the therapy accordingly.
  - Identify the duration of the close supervision by the doctor.
- To reduce patient hospital admission rate (as long as the attack can be recognized early).

2.3.3 Essential steps for making a “SMP”:

- The patient should be able to identify the warning signs (deterioration) mentioned above (2.1.1); and to remember that symptoms usually start sometimes after PEF readings have started to fall !.
- Calculate a **Percentage target** for PEF (always best of three readings) through discovering the best PEF of the patient; or his predicted value & then to use this as a benchmark or standard.
- **Three action level lines** have to be drown at 80%, 60% & 40% of the best reading or predicted value. Then three lines should be drown across the chart

at these 80%, 60 % & 40% levels and used as a guidelines.

- The patient should monitor his PEF 2 times/day; morning and evening, in the same position & at the same time each day, and keep ongoing records (preferably using PEF charts) to detect worsening or control of their condition. The patient should also record symptoms and exposure to allergens or triggers and medications taken.
- Also the patient should be taught how to calculate **the daily variation** of PEF:
- By dividing the highest by the lowest e.g. 400/300=1.33; the figure after the decimal point represents the variation, therefore being 33% (you can calculate this variability by using another method mentioned under the title patients discharge status 3.9.2). If the figure is > 40% the patient is severely ill & if above 15% the asthma is uncontrolled.

2.3.4 Steps (Zones) of Self-Management Plan:

The patient should adjust therapy in response of increased symptoms and or changes in PEF measurements, considering the following rules (Annex1)

- **A-Zone 1:** If PEF readings stay above the top line, and there is no or minimal symptoms then asthma is well controlled & no change in treatment.
- **B-Zone 2:** If PEF readings drop below the top line (≤ 80% of best), double the usual Preventive treatment, & continue until the PEF reaches the previous "normal level"; count the number of days it took to get back to this normal level & then continue the

double dose for the same number of days. If better resume the usual dose of inhaled steroid.

- **C-Zone 3:** If PEF readings drop below the bottom line **(**≤ 60%), this is a dangerous sign; first don't panic then do the following:
  - Prednisolone tablets (rescue dose) are needed
  - Continue steroids until the previous normal level is attained. Then count the number of days it took & continue on half the dose of oral steroids for the same number of days.
- **D-Zone 4:** If PEF readings drop below the bottom line (≤ 40%), this is a dangerous zone & indicates severe asthma attack; first don't panic then do the following:
  - Contact doctor or emergency help.
  - If any delay go direct to hospital.
  - Take 30-60mg prednisolone now as a single dose.
  - Take 4-10 puffs of reliever using a spacer every few seconds, up to 30 puffs

The patient can be shown how to record PEF readings, increasing symptoms on the chart, recognize when to adjust medication & when to call for help.

The overall treatment & management goal should be to achieve a less then 20% & ideally 10% difference between evening & morning rates.

Daily follow-up by the patient using the PEF chart (Annex 9), as part of the therapy for acute severe asthma helps in determining the shortest possible course of oral steroids for patients.

2.4 Follow up and referral to hospital:

2.4.1 Follow up:

The Patient should be seen weekly at the beginning of the treatment until control of the initial symptoms and then setting him in the proper management plan. Thereafter the patient should be seen regularly every 3-6 months in order to ensure the following:

- Assessment of the patient's response to treatment & identification of his control level.
- Checking number of hospital admissions during the previous period & their reasons.
- Check reasons of management failure if any.
- Adherence of the patient to the self-management plan.
- Checking the inhalation technique.
- Reinforce lifestyle modifications as appropriate.
- Reinforce avoidance of trigger factors.
- Reinforce health education as appropriate.
- Change management plan as appropriate up or down if necessary.
- Monitor the development of complications and medications adverse effects.
- Modification of the self-management plan as appropriate.

2.4.2 Referral to hospital:

Criteria for Immediate referral:

A. Any life threatening features.
B. Any features of severe attack that persist after initial treatment.
C. PEF 15-30 min after nebulisation < 33% of predicted or best value.
D. Child with failure to respond to or who has early deterioration after inhaled bronchiodilators.

Criteria for normal (cold) referral:

A. Uncertain diagnosis; for example: those with systemic symptoms for instance, fever, rash, weight loss, or proteinuria; that might suggest associated disorders such as systemic eosinophilia or vasculitis.
B. Those with unexplained persistent cough.
C. The patient not responding to treatment.
D. Unacceptable side effects of medication.
E. The patient require frequent courses of oral-corticosteroid.
F. Occupational asthma.
G. Patients whose asthma is interfering with their lifestyle despite changes in treatment.
H. Abnormal lung function persists when the symptoms are apparently controlled.

Lower threshold for referral is appropriate in patients:

A. Seen in the afternoon or evening rather than earlier in the day.
B. With recent onset of nocturnal symptoms or worsening of symptoms.
C. Who have had previous severe attacks, especially if the onset was rapid.
D. In whom there is concern over their assessment of severity of symptoms.
E. In whom there is concern over the social circumstances or relatives ability to respond appropriately.

PART FOUR: MANAGEMENT OF ACUTE SEVER ASTHMA:

1. Criteria for hospital admission:

1.1 A patient who shows no response to β_2 agonists or his PEF does not improve to at least 70% of his personal best following three hours of intensive therapy in the emergency room.

1.2 A patient requiring a β_2 agonists more frequently than every four hours.

1.3 A patient with a past history of acute life-threatening asthma.

1.4 A patient with PEF less than 50% of personal best after the first hour of intensive therapy in the emergency room.

1.5 Presence of factors indicating high risk of asthma-related mortality.

1.6 Social factors that may interfere with asthma care.

Patients may be admitted to the general ward or the intensive care unit depending on the severity of the case and the facilities available at the hospital.

2. Management of a severe asthma attack in children ≤5 years:

2.1 Aims of management:

2.1.1 To prevent death.

2.1.2 To restore the patient's clinical condition and lung function to their best possible levels as soon as possible.

2.1.3 To maintain optimal function and prevent early relapse.

2.2 Investigation of the circumstances of admission:

In all cases ask:

2.2.1 Was there an avoidable precipitating cause?

2.2.2 An allergy history should be taken.

2.2.3 Was the admission due to a catastrophic sudden attack or gradual deterioration before the acute attack?

2.2.4 Did the patient or relatives react appropriately to worsening asthma?

2.2.5 Was the patient complying with regular treatment, and if not why not?

2.2.6 Was medical management appropriate?

2.3 Immediate Treatment:

2.3.1 High flow oxygen via face mask.

- Salbutamole 5mg or Turbutaline 10mg (If available in the EDL),via an oxygen driven nebuliser (half-doses in very young children)
- Prednisolone 1-2mg/kg body weight orally (Maximum 40mg).

Arterial blood gas tension should be requested if the child is not responding or is deteriorating despite treatment.

2.3.2 If life threatening features are present:

- Nebulised β agonist more frequently, up to every 20-30 minutes; Salbutamole 0.15mg/kg
- Give IV. Aminophylline 5mg/kg over 20 minutes followed by maintenance infusion of 1mg/kg/h; with ECG monitoring, omit loading dose if child already receiving oral theophyllines
- Give IV. Hydrocortisone 100mg 6 hourly
- Monitor by Pulse oximetry (assessing response to treatment); maintain saturation above 92%
- Add Ipratropium 0.25mg to nebulised β agonist (0.125mg in very young children) may be helpful.
- An $SaO_2 \leq 92\%$ may indicate the need for chest radiography.

2.4 Subsequent management for acute severe asthma:

2.4.1 If patient is improving continue:

- High flow Oxygen
- Prednisolone 1-2mg/kg daily (maximum 40mg/day)
- Nebulised β agonist 4 hourly.

2.4.2 If Patient is not improving after 15 – 30 minutes:

- Continue Oxygen and Steroids.
- Give nebulised β agonist more frequently, up to every 20-30 minutes.
- Add Ipratropium to nebuliser and repeat up to every 20-30 min with β agonist during the first two hours reduce the frequency as the clinical improvement occurs.

2.4.3 If Patient is still not improving give:

- Aminophylline infusion (0.9mg/kg/h); monitor blood concentrations if continued for over 24 hours. Consider:
- IV single dose of Magnesium sulphate up to 40mg/kg/d by slow infusion.
- Some patients require rehydration by IV fluids & correction of electrolyte imbalance; hypokalaemia can be caused or exacerbated by β agonists or steroid treatment and must be corrected.

2.5 Monitoring Treatment:

2.5.1 Repeat & record PEF measurement 15-30 minutes after starting treatment (if appropriate)

2.5.2 Oximetry: maintain $SaO_2 \geq 92\%$

2.5.3 Chart PEF if appropriate before & after the child inhales β agonists and at least 4 times daily throughout hospital stay.

2.6 Transfer to the ICU accompanied by a doctor prepared to intubate if there is:

2.6.1 Deteriorating PEF, worsening or persisting hypoxia (SPo2<92% after initial bronchodilator), or hypercapnia,

2.6.2 Exhaustion, feeble respiration, confusion or drowsiness

2.6.3 Coma or respiratory arrest.

2.7 Requirements at discharge from hospital patients should have:

2.7.1 Been on discharge, medication for 7 days and have had inhaler technique checked and recorded.

2.7.2 If recorded, PEF or FEV1 > 75% of predicted or best and PEF diurnal variability < 25%, SPo2 >94%

2.7.3 Treatment with soluble steroid, tablets and inhaled steroids in addition to bronchiodilators.

2.7.4 Appropriate self management plan and written instructions for patients.

2.7.5 General practitioner follow up arranged within 1 week

3. Management Of Acute Severe Asthma In School Children and Adults:

3.1 Aims of management:

3.1.1 To prevent death.

3.1.2 To restore the patient's clinical condition and lung function to their best possible levels as soon as possible.

3.1.3 To maintain optimal function and prevent early relapse.

3.2 Investigation of the circumstances of admission: In all cases ask:

3.2.1 Was there an avoidable precipitating cause?

3.2.2 An allergy history should be taken.

3.2.3 Was the admission due to a catastrophic sudden attack or gradual deterioration before the acute attack?

3.2.4 Did the patient or relatives react appropriately to worsening asthma?

3.2.5 Was the patient complying with regular treatment, and if not why not?

3.2.6 Was medical management appropriate?

3.3 Immediate treatment:

3.3.1 Begin the following at once:

- Oxygen: use the highest concentration available with a high flow rate.
- High dose of inhaled β agonists: give Slabutamol 5mg or trebutaline 10mg (not available in EDL);This may be nebulised with Oxygen (in hospital and during transport to hospital), or multiple actuation's of metered dose inhaler into a large spacer device (two puffs 10-20 times) if the previous is unavailable.
- High doses of systemic steroids: give prednisolone 30-60mg or IV. Hydrocortisone 200mg, or both, immediately.

3.3.2 If life threatening features are present:

- Add ipratropium (0.5mg) to the nebulised β_2 agonist.
- Give IV. Aminophylline (250mg over 20 min) or salbutamol or terbutaline (250 μg SC. over 10 min), do not give bolus aminophylline to patients already taking oral aminophyllines.
- IV single dose of Magnesium sulphate 1.2-2g by slow infusion over 20 min.

3.4 Subsequent Management:

3.4.1 Continuation of treatment:

- Ensure that a nurse or doctor stays with the patient for at least 15 mniutes and certainly until clear improvement is seen.
- Continue Oxygen therapy.
- Continue high doses of steroids; Prednisolone tablets 30-60mg daily (or IV. Hydrocortisone 100mg every 6 hours in patients who are seriously ill or vomiting).

3.4.2 If patient is improving continue:

- Continue to give nebulised β agonist every 4 hours.

3.4.3 If patient has not improved after 15-30minutes.

- Give nebulised β agonist more frequently, every 15-30 minutes.
- Add Ipratropium 0.5 mg to nebuliser solution and repeat 6 hourly until improvement starts.
- Continue Oxygen and Steroids.

3.4.4 If patient is still not improving give:

- Aminophylline, 5mg/kg as loading dose then infusion of 0.5-0.7mg/kg/h); must monitor blood concentrations if continued for over 24 hours (Lower doses may be needed in patients with liver disease or heart failure and in those taking Cimetidine and most quinolone and macrolide antibiotics, higher doses are appropriate in smokers).
- Consider giving a single dose of IV. Magnesium sulphate 1.2-2gm infusion over 20 min. after consulting senior medical staff.
- Salbutamole 5μg / min or turbutaline infusion 1,5-5.0μg/min; (in ICU), the rate of infusion should be

adjusted according to the responses of the PEF & heart rate.

- Some patients require rehydration by IV fluids & correction of electrolyte imbalance; hypokalaemia can be caused or exacerbated by β agonists or steroid treatment and must be corrected.

3.5 Investigations in Hospital:

3.5.1 Arterial blood gas tension should be measured in patients with acute severe asthma who are admitted to hospita particularly those with Oxygen saturation(by pulse oximetry) < 92% or with other features of life threatening asthma.

3.5.2 Arrange for chest radiography in cases of:

- suspected pneumomediastinum, pneumothorax
- suspected consolidation
- life-threatening asthma
- failure to respond to treatment satisfactorily
- requirement for ventilation.

3.5.3 Arrange for measurement of plasma electrolytes and urea, a blood count and in older patients ECG.

3.6 Monitoring Treatment:

3.6.1 Repeat & record PEF measurement 15-30 minutes after starting treatment & thereafter according to the response at least 4 times daily throughout the hospital stay.

3.6.2 Record Oxygen saturation by oximetry; maintain SaO_2 ≥ 92%.

3.6.3 Repeat blood gas tensions measurement within 2 hours of starting treatment if:

- The initial PaO_2 is below <60mm Hg (8kPa)
- The initial Pa CO_2 is normal or raised; or
- The patient's condition deteriorates.

3.6.4 Measure them again if no improvement after 4-6 hours

3.6.5 Measure and record heart rate.

3.6.6 Measure serum aminophylline concentration, if continued > 24h. (aim at concentration of 55-110 μmol/L.

3.7 Transfer to the intensive care unit:

Transfer to the intensive care unit accompanied by a doctor prepared to intubate if there is:

3.7.1 Deteriorating PEF, worsening or persisting hypoxia; PaO_2 <60mmHg (< 8kPa) despite 60% inspired oxygen, or hypercapnia Pa CO_2 > 45mmHg (> 6kPa).

3.7.2 Exhaustion, feeble respiration, confusion or drowsiness.

3.7.3 Coma or respiratory arrest.

3.8 Indications for intermittent positive pressure ventilation:

3.8.1 Those with worsening hypoxia, or hypercapnia.

3.8.2 Drowsiness or unconsciousness.

3.8.3 Those who have had a respiratory arrest.

Intubation should be done by anesthetist or well trained doctor.

3.9 Patient's discharge status:

3.9.1 Symptoms have cleared,

3.9.2 PEF ≥ 75% of the predicted or best, & diurnal variation ≤ 25%

$$\frac{\text{(Highest PEF- Lowest PEF)}}{\text{Highest PEF}} \times 100 \text{ in each 24 hours.}$$

3.9.3 No nocturnal symptoms.

3.10 Changes in treatment and patient education before discharge:

3.10.1 Start Inhaled steroids at least 48 hours before discharge.

3.10.2 Nebuliser should be replaced by standard inhaler devices 24-48hours before discharge, unless he requires nebuliser at home.

3.10.3 Check inhaler technique & record it.

3.10.4 Monitor theophylline concentration if oral xanthine is required.

3.10.5 All patients should be taught how to use PEFM & how to respond to changes in symptoms & PEF.

3.10.6 They should know when to call their doctors or readmit them self to hospital.

3.10.7 All patients should have a written self-management plan.

3.11 Discharge letter:

3.11.1 Should include the PEF on admission and at discharge.

3.11.2 Details of treatment to be continued at home.

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www.asthma.org.uk
www.asthma-help.co.uk
www.ginasthma.com
www.docguide.com
www.familydoctor.org
www.thoracic.org
www.worlddallergy.org

Annex (1): Asthma self management plan chart based on symptoms and PEF to be used by the patient:

Zone	PEF	Symptoms	Significance	Action
1.	≥ 80% of best --------- l/min	-minimal or non	asthma under control	-continue present treatment
2.	≤ 80% ---------- l/min	-wakening at night -using reliever more than three times a week	asthma getting worse	-double dose of ---------- until back to zone 1 and then continue for the same number of days before reducing to usual dose.
3.	≥ 60% ---------- l/min	-increasing shortness of breath. -poor response to reliever -needing reliever every few hours -wakening at night	-asthma going out of control -risk of moving to danger zone	-start oral prednisolone -take-------mg prednisolone -continue until back to zone 1 then reduce to half this amount for the same number of days -contact doctor
4.	≤ 40% or less --------- l/min	-very distressed with severe symptoms -reliever lasts less than three hours	-danger zone -severe asthma attack	-contact doctor or emergency help -if any delay go direct to hospital -take---------mg prednisolone now as a single dose -take 4-10puffs of reliever using a spacer every few seconds, up to 30 puffs

Annex (2): The Catastrophic, Sudden Severe "Brittle" Asthma:

Type 1: They have wide PEF variability (>40% diurnal variation for > 50% of the time, over a period of > 150 days despite intense therapy).
Type 2: Sudden severe attacks on a background of apparently well controlled asthma.

Diagnosis & Management:

1. The asthma may become severe within minutes or a few hours
2. They are at great risk of sudden death.
3. Should be constantly reviewed by a respiratory physician,
4. Should carry a Medic-Alert bracelet or equivalent,
5. They must carry a β_2 agonists & Prednisolone at all times and have supply of drugs for emergencies to be kept in their handbag,
6. Should have Oxygen cylinder at home.

The management plan:

1. Call for help.
2. Inhaled a β_2 agonist at high dose (nebulised Salbutamole 5mg or terbutaline 10mg or two puffs from a MDI repeated 10-20 times) If this has failed on previous occasions, Adrenaline 0.5mg SC. May be helpful.
3. Prednisolone 30-60mg.
4. Go to the nearest hospital; he might need admission to the intensive care unit.

Annex (3): Criteria for diagnosis by Peak expiratory Flow Meter(PEM):

1. Random PEF readings as a percentage of predicted value may suggest a diagnosis of asthma which may be confirmed by further testing:-
2. **A daily variability** (diurnal variation between morning and evening), a variability of 20% or more over a short period (usually two weeks) is the key to diagnosing asthma.
   The daily Variation of PEF is calculated by

   $$\frac{\text{Highest - Lowest}}{\text{Highest}} \times 100$$
3. **Day to day variability**: the patient should record the morning PEF (pre bronchodilator if being used) and the previous evening's PEF (post bronchodilator if being used) values over a two week period. If variation > 20% the diagnosis of asthma is confirmed
4. **Reversibility tests:** 15% PEF response to bronchiodilator (200-400 µg) or courses of oral steroids is evidence of asthma.
5. **Response to exercise**; 15% reduction of PEF following exercise is indicative of asthma; 20% reduction is diagnostic.

Recommendations with PEF test:

1. Practices should standardize by using only one make of Peak Flow Meter, to avoid over-read in the middle of the range & or under- read in the higher segments of the range.
2. For those patients unable to use PFM , symptomatic response to treatment should be used to confirm diagnosis.

Measurement of PEF:

Most adults, as well as children above 5 years of age, usually can perform a PEF measurement. It helps in early detection of lung function deterioration & it gives important information about variability & helps in the management & monitoring of bronchial asthma.

Technique of PEF rate measurement:

1. The patient should take full inspiration to total lung capacity followed by a short maximal exhalation in a standing position.
2. Ideally, PEF measurements should be taken twice daily (preferably at the same time daily); immediately upon rising and 10-12 hours later.
3. On both occasions the patient should measure the PEF 3 times and note the highest number (plot it on the chart)

The **personal best** is the highest PEF measurement achieved when the patient's asthma is under control. This should be use as much as attainable.

PEF Normal values (in litres/minute) for Men ≥ 15 years:

Male Age/Year Height/Cm	15	20	25	30	35	40	45	50	55	60	65	70
160	530	570	595	605	610	605	600	585	570	555	535	520
168	545	580	605	620	625	620	615	600	585	565	550	530
175	555	590	615	630	635	635	625	610	595	580	560	540
183	565	600	630	640	650	645	635	625	605	585	570	550
191	575	610	635	650	660	655	650	635	620	600	580	570

PEF Normal values (in litres/minute) for Women ≥15

Female Age/year Height/cm	15	20	25	30	35	40	45	50	55	60	65	70
152	445	460	470	475	475	470	460	445	435	425	410	395
160	455	470	485	490	485	480	470	455	445	430	420	405
168	465	485	495	500	500	490	480	465	455	440	425	415
175	475	495	505	510	505	500	490	475	465	450	435	425

years:

PEF Normal values (in litres/minute) for both boys and girls<15 years:

Children PEF	95	120	145	175	210	235	260	285	310	335	360	385
Height /Cm	91	99	107	114	122	127	132	137	142	147	152	157

The variability of PEF:

provides a reasonable index of asthma stability and severity. One method of describing diurnal PEF variability is as the amplitudes expressed as a percentage of the mean daily PEF value. Another method is the minimum morning prebronchiodilator PEF over 1 week, expressed as a percent of the recent best (Min%Max).

Annex (4): Notes about Asthma Medications:

1. Anti-inflammatory Therapy

Sodium cromoglicate: In general prophylaxis with sodium cromoglicate is less effective in adults than prophylaxis with corticosteroids inhalation. Children may respond better than adults, although there is less evidence of efficacy in those under the age of 4 years. It has no value in the treatment of acute attack of asthma. And it needs 3-4 weeks of regular use before a significant effect is seen . it has almost no side effects. It can used in mild persistent childhood asthma. The usual dose is 10mg (two puffs) 3-4 times daily as regular maintenance medication, this may subsequently be reduced. A nebulized form of 20mg/nebule for use 3-4 times daily is also available. It is of value in the prevention of exercise-induced asthma, a single dose being inhaled half-an-hour beforehand.

Nedocromil sodium: Has anti-inflammatory properties similar to or slightly better than sodium cromoglicate and possibly a faster onset of action , has no major side-effects usual dose is 4mg (2 puffs) 3-4 times daily.

Beclomethasone (Becotide or Becloforte) and Budesonide (pulmicort): Most widely use inhaled steroids, very effective they reduce bronchial mucosal inflammation, side effects are uncommon and do not usually interfere with therapy; oral thrush, hoarseness & small increased risk of glaucoma & cataracts with prolonged high-doses of inhaled corticosteroids; these are reduced by using spacer devices and rinsing the mouth after use. The growth retardation in children associated with oral corticosteroid therapy does not appear to be a significant problem with recommended doses of inhaled therapy.

However the height of children receiving prolonged treatment should be monitored Becotide comes as MDI 50 & 100mcg/puff, while Becloforte comes in 250mcg/puff. Pulmicort comes as Turbohaler 100-200mcg/inhalation, and as a nebulizer solution, 0.5 or 1mg in 2cc nebules. Corticosteroid aerosol inhalations must be used regularly to obtain maximum benefit. *Alleviation of symptoms usually occurs 3-7 days after initiation.*
Beta 2 agonist should be used first to help increase the penetration of the inhaled corticosteroid.
Patients on high aerosol inhalation doses might need oral corticosteroid cover during an episode of stress (e.g. an operation or infection.

Fluticasone (Flixotide): achieves the same effect as the other two with half the dose when given by an equivalent delivery . & may have less systemic side effects.

Leukotriene-receptor antagonists (LTRA's): Can be considered as an alternative to increased doses of inhaled glucorcorticosteriods. In children and adults. LTRA's can be used as adjunct therapy to moderate or higher doses of inhaled glucocorticosteroids to achieve control of persistent asthma
There is insufficient evidence to recommend LTRA's as first-line anti-inflammatory, however, for patients who cannot or will not use inhaled glucocorticoids.
They are taken orally e.g. Zafirlukast, Montelukast, and Zileuton; Age has to be considered in recommending the drug and the dose.

Depot steroids: have no role in the treatment of bronchial asthma and may be dangerous.

2. Bronchodilator therapy:

Salbutamole (Ventolin) and Terbutaline (Bricanyl) are the most widely used short-acting β_2 agonists. These are best used by inhalation on intermittent basis for relief of acute episodes or during periods of increased symptoms. They are also the drug of choice for exercise-induced asthma. Onset of action is rapid, usually within minutes of administration and effects last for four to sex hours. Long-term regular use should be avoided, since it may be associated with increased bronchial hyperreactivity.

Common side effects include tachycardia and tremors, and could be reduced by using spacer devices or reducing the dose. These side effects are not usually of a serious nature. Recommended dose is 200 μg via inhaler or 400 μg via turbohaler every four to sex hours as needed or 2.5 to 5mg via nebulizer. In infants and younger children a dose of 0.15mg/kg/dose up to a maximum of 5mg could be used via nebulizer. In certain situation the dose may need to be given more frequently (e.g. in the emergency room). If inhalers are needed for more than once a day, prophylactic treatment should be considered.

And Regular need of more than every four hours requires professional medical attention. Oral use should be discouraged, except in certain situations where slow-release tablets for nocturnal symptoms are used. Ventolin comes in metered dose inhalers of 100μg per puff and nebulizer solution of 5mg/ml. When nebulizer solution is used, the dose nebulized should be in a total volume of 2-3ml, with the difference in volume made up by normal saline. Terbutaline comes in a turbohaler of 400 μg per inhalation. Careful

instruction on how to use inhaler has to be given, as well as regular check on the correct continual use.

Ipratropium bromide (Atrovent): This is an anticholinergic agent that has additive bronchodilator effect when used with β_2 agonists. It is useful in severe acute asthma at doses of 250μg to 500 μg via nebulizer every 4 to 8 hours, in addition to β_2 agonists that would be used more frequently. It is also useful in the continuous care of some adults, and the dose is 40μg 3-4 time per day, in addition to inhaled steroids. It comes in a nebulizer form of 250 μg per ml and metered dose inhaler of 20μg per puff.

Methylxanthines: can be considered in severe acute asthma when there is incomplete responsiveness to optimal doses of bronchodilator and steroids. Long-term slow-release theophylline can be used in the management of moderate to severe asthma in addition to anti-inflammatory medications, provided levels are followed regularly. A level of 5-15mg/ml should be targeted and doses adjusted accordingly. They may be also used for the control of nocturnal symptoms in asthma.

Salmeterol (Serevent) and formoterol (Oxis): are long-acting β_2 agonists with effects lasting over 12 hours. They are used in addition to inhaled steroids on a regular basis if asthma control is not adequate. They also seem to be helpful in nocturnal asthma. More data is coming out regarding their safety and effectiveness in children and they may be recommended in children requiring high doses of inhaled steroids.

They should not be used for relief of acute symptoms or without regular inhaled steroids. Salmeterol comes in a metered dose inhaler of 25μg /puff and diskhaler of 50μg per inhalation and the usual dose is 50μg every 12 hours.

Formoterol comes in turbohaler form of 9μg per inhalation and the usual dose is 12 μg every 12 hours.

Non-selective adrenergic agents, such as **isoproterenol and adrenaline**, have been replaced by the safer and more effective β_2–selective agents. Therefore, they should not be used in asthma therapy. An exception is when a patient presents with severe life-threatening asthma, where a subcutaneous adrenaline is given while the patient is receiving aerosol β_2–agonist.

3. Other Treatments :

Antibiotics, antihistamines, mucolytics and anti-tussives have no special role in asthma therapy.

Ketotifen: Is an antihistamine with possible anti-allergic effects and currently has no established role in asthma therapy.

4. Alternative Treatments of Asthma:

There are alternative treatments for asthma such as Intravenous Immunoglobulin, Immunotherapy (Desensitization), Herbal medicine, and Acupuncture. There role as asthma therapy is very limited and not without risks, therefore they should NEVER be tried outside a tertiary care centre.

Annex (5): Methods of Delivering Inhaled Therapy:

Metered dose inhaler (MDI): Most children will be unable to use this without a spacer device.

Dry powder inhalatioin: For example, rotahaler, turbohaler, diskhaler, spinhaler, and discus. Most children over 5 years and adults would be able to use these directly.

Spacers: These are devices that improve the delivery of medications from an MDI, reduce their systemic absorption and local side effects. Should be used in conjunction with MDI in all children and adults using high-dose inhaled steroids.

Nebulizers: Are most helpful for patients under 2 years of age and those having difficulty with other delivery systems.

Inhaler devices in children:

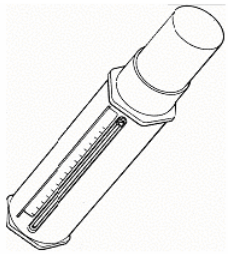
The most common reason for failure of inhaled drugs in children is inappropriate selection or incorrect use of an inhaler. The box below indicates which devices are suitable according to age and gives some suggested dosages.

INHALER DEVICES IN CHILDHOOD		
	Relief	**Prevention**
0-2 years Large volume spacer + Face mask (MDI)	Ipratropium up to200μg Salbutamole up to 1mg Terbutaline up to 2.5mg	Cromoglycate(5mg) 10mg tds Beclomethasone 50-200μg bd Budesonide 50-200μg bd
Coffee cup (MDI)	Ipratropium up to200μg Salbutamole up to 1mg Terbutaline up to 2.5mg	Cromoglycate 20mg tds Budesonide 500μg bd
Nebuliser	Ipratropium 0.25mg Salbutamole 2.5mg Terbutaline 5mg	
3-4 years Large volume spacer(MDI)	Salbutamole up to 2mg Terbutaline up to 5mg	Cromoglycate(5mg) 10mg tds Beclomethasone 50-200μg bd Budesonide 50-200μg bd
Nebuliser	Salbutamole up to 2.5-5mg Terbutaline up to 5-10mg	Cromoglycate 20mg tds Budesonide 500μg bd
5 years & above Autohaler Diskhaler or Rotahaler Spinhaler Turbohaler	Salbutamole 100μg Salbutamole 200-400μg Terbutaline 500μg	Beclomethasone 50-200μg bd Cromoglycate 20mg tds Budesonide 50-200μg bd

Notes:

1. When large volume spacers are used actuate the metered dose inhaler (MDI), breath in one puff, repeat the actuation, then breath in the second puff. Continue until the appropriate number of puffs has been inhaled.
2. The doses of relief medication for the 0-2 and 3-4 years age groups are maximal doses. Often smaller amounts will suffice.
3. Some children under 5 years can inhale powdered drugs, especially with the Turbohaler or Diskhaler
4. Some children receiving powdered drugs for prevention need an MDI plus large volume spacer device for relief treatment
5. Relief treatment outside hospital can repeated 2-4 hourly but failure to respond or early dterioration requires immediate medical assessment.
6. Nebulisers are overused both in hospital and in the community. They are expensive, time consuming, and inefficient. They may often be replaced by large volume spacer devices.
7. Every child given inhaled steroids from an MDI should use a large volume spacer to enhance deposition of the medication in the lungs

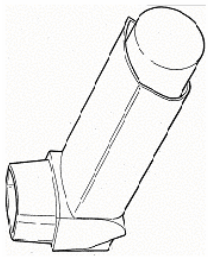
Annex (6): How to use Peak expiratory flow meter and other related devices



HOW TO USE THE PEAK FLOW METER 1

1. Stand up if possible.
2. Check cursor is on zero. (L/Min position)
3. Take a deep breath in and place Peak Flow Meter in the mouth (hold horizontally), and close lips.
4. Blow suddenly and hard.
5. Note number indicated by cursor.
6. Return cursor to zero.
7. Repeat twice and obtain three readings.
8. Write down the best of the three readings.

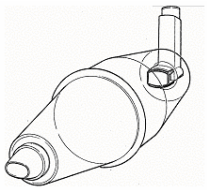
ALWAYS DEMONSTRATE TO THE PATIENT HOW TO USE THE METER



HOW TO USE A METERED DOSE INHALER 2

1. Remove the cap and shake the inhaler
2. Breath out gently.
3. Put the mouthpiece in the mouth and at the start of inspiration, which should be slow and deep, press the canister down and continue to inhale deeply.
4. Hold the breath for 10 seconds, or as long as possible.
5. Wait about 30 seconds before taking another inhalation.

ALWAYS DEMONSTRATE TO THE PATIENT HOW TO USE THE METERED DOSE INHALER

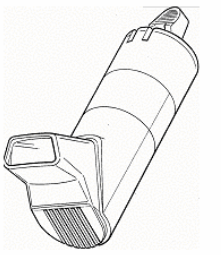


HOW TO USE A SPACER DEVICE
e.g. VOLUMATIC 3
Method for patients who can use the device without help

1. Remove the cap, shake the inhaler and insert into the device.
2. Place the mouthpiece of the volumatic in the mouth.
3. Press the canister once to release a dose of the drug into the device.
4. Take a deep, slow breath in.
5. Hold the breath for about 10 seconds, then breath out through the mouthpiece.
6. Breath in again but do not press the canister.
7. Remove the device from the mouth.
8. Wait about 30 seconds before a second dose is taken, and repeat section 1-7

ALWAYS DEMONSTRATE TO THE PATIENT HOW TO USE THE SPACER DEVICE

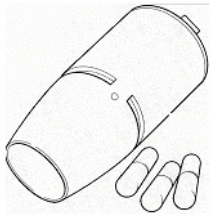
HOW TO USE THE AUTOHALER DEVICE 4



1. Remove protective mouthpiece and shake the inhaler.
2. Hold the inhaler upright and push the grey lever right up.
3. Breath out gently. Keep the inhaler upright and put the mouthpiece in the mouth and close lips round it. (The air hole must not be blocked by the hand).
4. Breath in steadily through the mouth. DON'T stop breathing when the inhaler 'clicks' and continue taking a really deep breath.
5. Hold the breath for about 10 seconds.
6. Wait at least 60 seconds before taking another inhalation.
7. N.B. The lever must be pushed up ('on') before each dose, and pushed down again ('off') afterwards, otherwise it will not operate.

ALWAYS DEMONSTRATE TO THE PATIENT HOW TO USE THE AUTOHALER

HOW TO USE THE ROTAHALER DEVICE 5

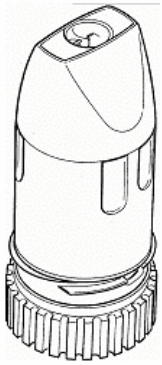


1. 1.Hold Rotahaler vertically and put capsule coloured end uppermost into 'square hole. Make sure top of Rotacap is level with top of hole. (If there is a Rotacap already in the device this will be pushed into shell).
2. Hold Rotahaler horizontally, twist barrel sharply forwards and backwards.This splits capsule into two.
3. Breath out gently. Keep Rotahaler level and put mouthpiece between lips and teeth and breath in the powder quickly and deeply.
4. Remove Rotahaler from the mouth and hold breath for about 10 seconds.

If any powder is left repeat step 3 and 4.

ALWAYS DEMONSTRATE TO THE PATIENT HOW TO USE THE ROTAHALER

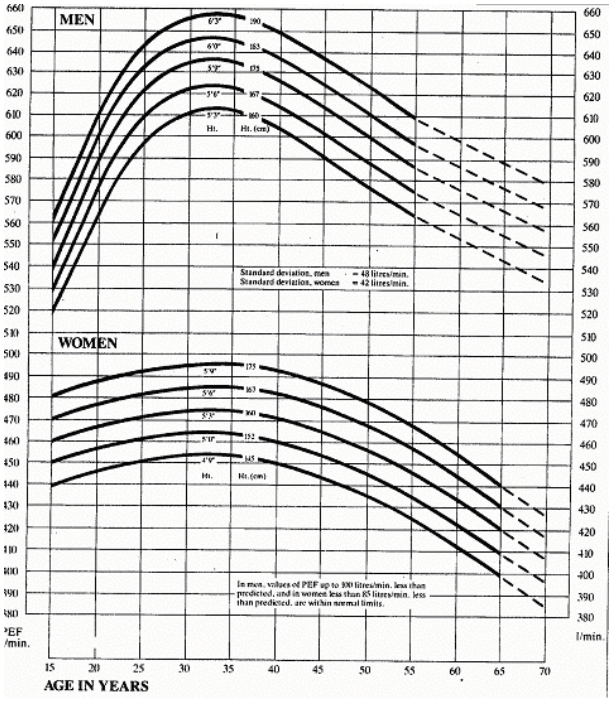
HOW TO USE THE TURBOHALER DEVICE 6



1. Unscrew and lift off white cover.
2. Hold turbohaler upright and twist grip forwards and backwards as far as it will go. (you should hear a click)
3. Breath out gently, put mouthpiece between lips, and breath in as deeply as possible.
4. Remove turbohaler from the mouth and hold breath for about ten seconds.

ALWAYS DEMONSTRATE TO THE PATIENT HOW TO USE THE ROTAHALER

Annex (7): Peak expiratory flow in normal adults



Nunn AJ, Gregg 1 New regression equations for predicting peak expiratory flow in adults, BMJ 1989, 298: 1068-70

Annex (8): Special Considerations in Asthma:

1. Cough variant asthma:

This form of asthma presents only as a chronic cough only. The chest x-ray is usually normal. Cough variant asthma is a common problem among all ages, and can go unrecognized, Spirometry can be within normal limits. It is recommended that a patient with a non-productive, nocturnal cough lasting more than 2 weeks without obvious cause should receive an empirical bronchdilators and / or anti-inflammatory medications.

2. Exercise-induced Bronchospasm EIB:

Exercise-induced Bronchospasm affects 75-80% of asthmatics. The patient should lead a normal life without limitation of exercise. Inhaled β_2 agonist are the most effective drug for prevention, There is no role for oral β_2 agonists. Two puffs of Salbutamole, 10-20 minutes prior to exercise is effective in 80-95% of patients. Two puffs of Cromolyn 10 minutes prior to exercise prevents EIB in some asthmatics without using any medications. Treating poorly controlled asthma with proper anti-inflammatory medication will help prevent EIB.

3. Nocturnal asthma:

Often nocturnal asthma is a manifestation of poor control of asthma with inadequate anti-inflammatory therapy. The control of asthma has to be carefully reviewed . environmental triggers have to be excluded. Long acting inhaled β_2 agonist or slow release theophylline are effective, in addition to anti-inflammatory agents.

4. Asthma in pregnancy:

Several physiological changes occur during pregnancy which could worsen or improve asthma.

Pregnancy can affect the course of asthma and asthma can affect pregnancy outcomes (uncontrolled asthma in pregnancy can adversely affect the fetus).

Offer pre-pregnancy counselling to women with asthma regarding the importance and safety of continuing their asthma medications during pregnancy to ensure good asthma control.

Monitor pregnant women with asthma closely so that any change in course can be matched with an appropriate change in therapy.

Advice women who smoke about the dangers for themselves and their babies and give appropriate support to stop smoking.

Asthma therapy in pregnancy:

1. Use beta agonists as normal
2. Use inhaled steroids as normal.
3. Use oral and intravenous theophyllines as normal.
4. Use steroid tablets as normal when indicated for severe asthma. Steroid tablets should never be withheld because of pregnancy.

Acute asthma in pregnancy:

Give drug therapy for acute asthma as for non-pregnanat patient

Acute severe asthma in pregnanacy is an emergency and should be treated vigoursly in hospital.

Deliver oxygen immediately to maintain saturation above 95%.

Continuous faetal monitoring is recommended for acute severe asthma.

For women with poorly controlled asthma there should be close laison between the respiratory physician and the obstetrician.

Management during labour:

1. If anaesthesia is required, regional blockade is preferable to GA.
2. Use prostaglandine F2α with extreme caution because of the risk of inducing bronchoconstriction.
3. Advise women: that acute asthma is rare in labour.
4. To continue their asthma medications in labour.

Women receiving steroid tablets at a dose exceeding prednisolone 7.5mg per day for > 2 weeks prior to delivery should receive perenteral hydrocortisone 100mg 6-8 hourly during labour.

In the absence of acute severe asthma, reserve caeserian section for the usual obstetric indications.

Drug therapy in breastfeeding mothers:

Encourage women with asthma to breast fed.

Use asthma medications as normal during lactation.

5. Seasonal Asthma:

In some sensitized individuals, asthma may be exacerbated by seasonal increases in specific aeroallergens. Examples include birch, grass, Alternaria, and ragweed pollens. Seasonal asthma is usually associated with allergic rhinitis. This type of asthma may occur only intermittently, with the patient being entirely asymptomatic between seasons. Alternatively, it may occur as a seasonal worsening symptoms in a patient with persistent asthma.

6. Aspirin-Induced Asthma:

In 4-28% of adults with asthma, aspirin and other NSAID's medications may cause asthmatic exacerbation that may be at times be severe enough to cause respiratory arrest. Such patients frequently have a long history of rhinitis and may develop nasal polyps.

Their asthma may be protracted and difficult to treat. They should avoid aspirin and other NSAID's for the rest of their lives.On rare occasions, if there is a need to give such medications, patients may need desensitization under the supervision of an experienced allergist in a properly equipped medical centre.

Leukotriene antagonists may have a role in the treatment of such patients.

Some medications that may be tolerated if an analgesic is needed in such patients include Sodium salicylate, dextropropoxyphene and paracetamole (Acetaminophen). With paracetamole, the first dose (half tablet) should be given under supervision, since a small percentage of such patients may react.

Other medications that should be avoided or given only after special precautions are taken in asthmatics include β blockers, amphotericin B, oestrogen, cisapride, nitrofurantoin and vinblastine.

7. Surgery:

Asthmatics are at increased risk of intra-operative and postoperative complications. Factors that influence such complications include the site of surgery, type of anaesthesia, endotracheal Intubation, the presence of asthma symptoms and airway hyperresponsiveness . Ideally, asthmatics should be evaluated 1-2 weeks prior to surgery to optimize and possibly step up therapy.

Patients who had received systemic steroids within the previous 6 months should receive systemic coverage during the surgical period and be rapidly tapered over the following 24 hours. Nebulized β_2 agonists may be given preoperatively as a preventive measure. Every attempt should be made to have elective surgeries performed when asthmatics are under optimal control with no evidence of airway hyperresposiveness, as evidenced by absence of symptoms or normal pulmonary function testing or PEF.

8. Occupational asthma:

It may cause deterioration in pre-existing or may be the cause of asthma occurring for the first time. At the initial asthma visit therefore it should always be determined whether or not there is any relationship between the onset of asthma symptoms and the workplace.

Symptoms usually occur after exposure to the allergen, but a decline in PEF may be delayed for hours or days. Improvement is noted during a break from work, ie. Over holiday period.

Confirmation is by PEF recording both at work and at home. Once diagnosed exposure should be completely avoided as continual exposure may lead to irreversible airways obstruction and/ or severe potentially fatal exacerbation's.

A list of agents causing asthma in selected occupations is given in the following table:

Agents Causing asthma in slected occupations:

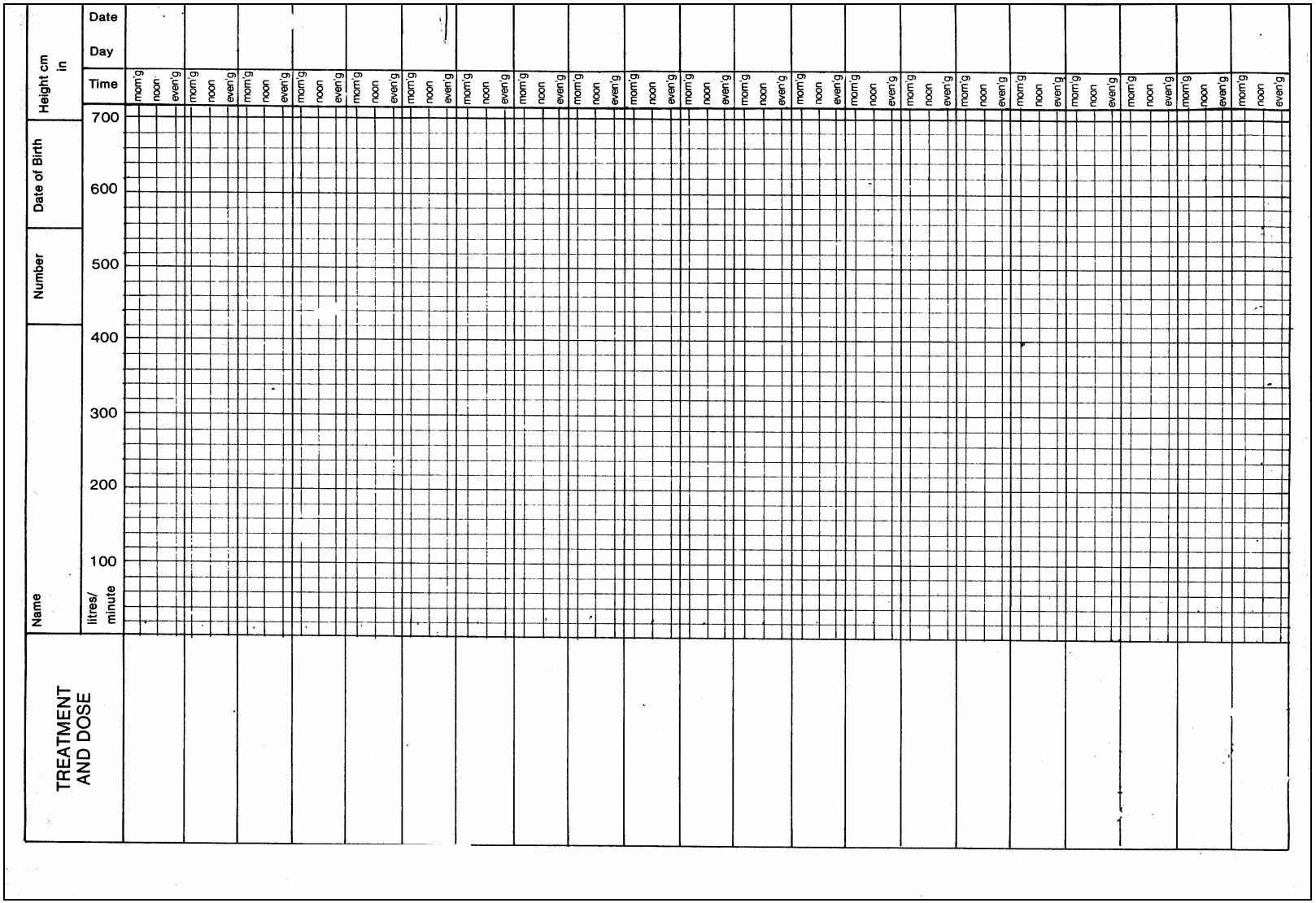
Occupation / occupational field	**Agent**
Laboratory animal workers, Veterinarians	Dander & urine proteins*.
Food processing.	Shellfish, egg proteins, pancreatic enzymes papain, amylase.
Dairy farmers.	Storage mites.
Poultry farmers.	Poultry mites, droppings, feathers.
Granary workers.	Storage mites, aspergillus, indoor ragweed,Grass pollen.
Research workers.	Locusts
Fish food manufacturers.	Midges
Detergent manufacturers.	Bacillus subtilis enzymes*
Silk workers.	Silk worm moths and larvae.

Agents Causing asthma in slected occupations (cont.):

Occupation / occupational field	Plant proteins
Bakers.	Flour, amylase*.
Food processing	Coffee bean dust, meat tenderiser (papain),tea.
Farmers	Soy bean dust.
Shipping workers	Grain dust (moulds, insects, grain)*
Laxative manufacturing	Ispaghula, psyllium.
Sawmill workers, carpenters	Wood dust (Western red cedar, oak, mahogany, zebrawood, redwood, Lebanon cedar, African maple, eastern white cedar).
Electric soldering	Colophony (pine resin).
Cotton textile workers	Cotton dust.
nurses	Psyllium, latex
Occupation / occupational field	**Inorganic chemicals**
Refinery workers.	Platinum salts, vanadium.
Plating.	Nickel salts.
Diamond polishing.	Cobalt salts.
Manufacturing.	Aluminium fluoride.
Beauty shop.	Persulfate.
Welding.	Stainless steel fumes, chromium salts.
Occupation / occupational field	**Organic chemicals**
Manufacturing.	Antibiotics, piperazine, methyle dopa, salbutamole, cimetidine.
Hospital workers.	Disinfectants(sulfathiazole,chloramine,formaldehyde, glutaraldehyde).
Anesthesiology.	Enflurane.
Poultry workers.	Amprolium.
Fur dyeing.	Paraphenylene diamine.
Rubber processing.	Formaldehyde, ethylene diamine, phthalic anhydride.
Plastics industry.	Toluene diisocyanate, hexamethyl diisocyanate, dephenylmethyl isocyanate, phthalic anhydride, triethylene tetramines, trimelitic anhydride, hexamethyl tetramine.
Automobile painting.	Dimethyl ethanolamine diisocyanates.
Foundry worker.	Reaction product of furan binder.

* = high molecular weight

ANNEX (9): PEF chart



Annex (10): Asthma Record Card:

Palestinian MOH Asthma Record Card												
Name:				Address:								
DOB:				File no:				Occupation				
See list of agents causing asthma in selected occupations on page												
First visit												
Asthma diagnosis confirmed Yes No	% of predicted PEF best of 3 readings	Asthma severity guide Intermittent (1) Mild persistent (2) Moderate persistent (3) Severe persistent (4)		Present treatment step if any 1-4		Treatment step as a result of this visit 1-4		Inhaler type prescribed		Type of spacer device prescribed		Precipitants Active smoking Passive smoking Aspirin NSAIDs β-blockers domestic pets others Tick as appropriate
House dust mite avoidance advice and self management advice can be given now or at review.												
Review visits												
Date	Pulmonary function			Grade of control			Inhaler technique Suitability of device and compliance All checked	Is a spacer Device being used	Treatment step 1,2,3,4, or step down	Has (or parents have) and understands how to use a SMP	Has a PEFM & knows (or parents know) what 60% and 40% of best	Smokes Yes/no
	PEF	% of best	Variability 2-3 weeks	Good	Poor	None						
Best ever recorded PEF												
Date												
PEF												
Any time a new personal best PEF is recorded at home or in the clinic update this chart. The latest figure is the one used both for assessing asthma control and for self management.												
Date of asthma exacerbations												
Hospital												
Nebulised at home or clinic												
Course of oral steroids												